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POSTAL REGULATORY COMMISSION
WASHINGTON, D.C. 20268–0001

PERIODIC REPORTING (UPS PROPOSALS ONE, TWO, AND THREE)	Docket No. RM2016-2

REPLY COMMENTS OF THE UNITED STATES POSTAL SERVICE ON PROPOSALS ONE AND TWO
(March 25, 2016)

UPS's case for its proposals is woefully deficient, and none of the initial comments offer the Commission any valid additional grounds for adopting UPS's proposals. Among the many parties that have analyzed UPS's proposals, there is near-unanimity that they fail to meet the relevant statutory criteria. Two parties support only the result that the proposals would produce, but they stop short of endorsing UPS's proposals as the means to that end.

The sole exception is the Public Representative, and he only endorses Proposal One to the extent that he believes it could be applied to market-dominant products. This position rests on too many misconceptions about the established costing methodology, key economic concepts, and precedent for the Commission to give it serious weight. Similar misconceptions plague Valpak's discussion of Proposal One. For these reasons, the scant support for UPS's Proposal One has no merit and certainly does not compensate for the fatal shortcomings in UPS's own case.

I. THERE IS VIRTUAL CONSENSUS THAT UPS HAS FAILED TO DEMONSTRATE THAT ITS PROPOSALS ARE LEGALLY OR LOGICALLY SUFFICIENT

Section I.A will focus on the five comments that address the merits of UPS's proposals: those of the Public Representative, the Parcel Shippers Association (PSA),

the American Catalog Mailers Association (ACMA), Amazon Fulfillment Services (Amazon), and a group of nine organizations that represent market-dominant mailers' interests (collectively, "Mailers"). In almost every material respect, these commenters agree with the Postal Service that UPS has failed to demonstrate that its proposals have legal or logical merit. Despite the Public Representative's anomalous view that Proposal One meets the "reliable-causation" standard (which will be discussed further in section II below), even he agrees that Proposal One should not be applied to competitive products, which is the object of UPS's proposal.

The National Postal Policy Council (NPPC) and Valpak Direct Marketing Systems and Valpak Dealers' Association (collectively, "Valpak") welcome the outcomes that UPS's proposals would have, but, as discussed in section I.B below, even they do not actually offer any principled support for UPS's specific proposals themselves.

A. The Commenters That Address the Merits of UPS's Proposals Generally Agree That the Proposals Are Invalid.

1. Almost every one of these commenters agrees that Proposal One fails to meet the statutory "reliable-causation" standard.

In its initial comments, the Postal Service explained that the governing legal standard, which is based on 40 years of Commission and court precedent, requires a "reliably identified causal relationship" between a cost and a product before that cost can be treated as attributable. USPS Comments at 5-9. As the U.S. Supreme Court and the Commission have explained, this approach stands in stark contrast to the arbitrariness of fully-distributed costing, yet Proposal One relies on an allocation algorithm that is essentially an elaborate version of fully-distributed costing. *Id.* at 14-27. Apart from computational errors, UPS's economic models and assumptions simply do not fit the Postal Service, which is a multiproduct firm with economies of scale,

scope, and density. *Id.* Moreover, Proposal One relies on a necessarily arbitrary fixation on which products are "first" and which are "last." *Id.* UPS can point to no other regulator that has adopted an approach like Proposal One. *Id.* at 9-13.

With the sole exception of the Public Representative (see section II below), each of the commenters that analyzes the merits of Proposal One agrees with the Postal Service that, whatever room for incremental improvement might exist, the fundamentals of the current costing system are legally and economically sound, whereas UPS's radically divergent Proposal One is not. ACMA Comments at 1-40; Amazon Comments at 22-69, 74-102; Mailers Comments at 3-13.[1] To the extent that the other comments point out flaws that might not be explicitly apparent from the Postal Service's initial comments, the Postal Service agrees with and incorporates those criticisms as well. *See, e.g.*, Amazon Comments at 39-41 (discussing the Kappel Commission and Congress's rejection of UPS's proposal that price regulation after the Postal Reorganization Act be based on fully-distributed costing); ACMA Comments at 10-11 & fn.13, 30-31 & fn.37 (same); Amazon Comments at 41-53, 93 (detailing the historical development of the Commission's costing approach and its rejection in R94-1 of a proposal to base pricing on Shapley-values-based cost allocation); *id.* at 83 ("It is entirely proper for a firm to pass through most (or even all) of its economies of scale and scope to customers in competitive markets through lower prices, as long as the rates paid by those customers cover the marginal and incremental costs of serving them . . . particularly . . . when (as here) the regulated firm competes directly with unregulated

[1] PSA does not specifically discuss the technical merits of Proposal One in its separate comments, but PSA is a co-sponsor of the Mailers Comments.

firms."); *id.* at 99-102 (debunking UPS's claims about private-sector cost accounting practices).

2. Every interested commenter agrees that Proposal One would worsen, not correct, distortions in the market for competitive products.

In its initial comments, the Postal Service pointed out that UPS's narrative about anti-competitive cross-subsidies is backwards: competitive product prices have actually increased far faster than market-dominant ones. USPS Comments at 35-37. Moreover, UPS's market share spreadsheet has a number of basic flaws that disqualify it from supporting UPS's arguments; even taken at face value, UPS's data seem to say less about the effects of the Postal Service's September 2014 price change (particularly since the reduced price cells represented only a tiny fraction of volume), and more about the 2014 holiday season and UPS and FedEx's expansion of Ground dimensional-weight pricing. *Id.* at 37-45. The Postal Service also reminded the Commission that a holistic view of the market must account for the Postal Service's unique legal burdens, which far outweigh any benefits arising from its legal status, to the point where the Federal Trade Commission (FTC) found that competitive product prices were artificially high, not artificially low. *Id.* at 46-47.

All of the other interested[2] commenters that address the merits, including the Public Representative, agree with the Postal Service that UPS has not supported its claims of market distortions that Proposals One and Two would supposedly correct and that UPS's comparison of competitive and market-dominant price increases is

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[2] The Mailers Comments do not discuss the UPS proposals' effects on the market for competitive products, presumably because those comments reflect the sponsors' interest in market-dominant mail.

diametrically at odds with the facts. Amazon Comments at 12-14, 69-74; ACMA Comments at 35-37; PSA Comments at 3-7; Public Representative Comments at 44-52.

As the Public Representative points out, the Postal Service's competitors are the very picture of financial health, dominate the supposed "market" that UPS's submissions have portrayed,[3] and show little actual sign of material risk from Postal Service activities. Public Representative Comments at 51-52. Insofar as it is valid to compare competing providers, the Commission should remain mindful of the fact that the Postal Service faces many unique disadvantages from which UPS and other competitors remain free, which hinder its ability to compete effectively. ACMA Comments at 36-37; *see also* Public Representative Comments at 16 fn.27 (quoting Federal Trade Commission, Accounting for Laws that Apply Differently to the United States Postal Service and its Private Competitors (2008) [hereinafter "FTC Report"], at 6); Postal Service Comments at 46-47 (discussing the Federal Trade Commission's (FTC's) specific finding that the Postal Service's overwhelming net competitive disadvantage causes competitive product prices to be artificially high).[4]

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[3] It bears noting that UPS's portrayal is highly flawed. *See* Postal Service Comments at 37-45. Nevertheless, the Public Representative and other commenters have a valid point insofar as even UPS's own submissions, with their relatively small Postal Service "market" share, contradict UPS's narrative of a Postal Service somehow able to dictate and distort market conditions. *See also* Amazon Comments at 13, 72-73; PSA Comments at 5-6.

[4] It is not clear why the Public Representative believes that merely reclassifying a market-dominant product as competitive would affect the legal burdens that the FTC found to disadvantage the Postal Service's competitive products. *See* Public Representative Comments at 3, 7, 17-18, 54. These transfers may have allowed the Postal Service to raise prices for the relevant products, but that has no effect on the costs that were the subject of the FTC's study (e.g., costs flowing from the Postal Service's inability to access Medicare Part D subsidies). As the FTC remarked, these inflated costs force competitive products to be priced higher than they otherwise would be, if the Postal Service were in the shoes of UPS or others, FTC Report at 64, and the entire market suffers when prices are set artificially high. This is true of competitive products no matter when they came to be classified as such.

Of course, product transfers can increase competitive products' share of total volumes and revenues. Those proportions did factor into the FTC's analysis, in terms of how it allocated the value of

Of course, the relevant concern is not for the state of UPS or other competitors, but for that of the market and consumers as a whole. Amazon Comments at 7-9, 13-14, 73-74. Adoption of UPS's proposals would themselves distort the market in ways that harm consumers, by forcing Postal Service prices to be artificially higher and sanctioning even higher pricing by its competitors. *Id.*; PSA Comments at 6-7.[5]

3. Every commenter addressing the merits of the proposals agrees that Proposal Two fails to meet the statutory "reliable-causation" standard.

As the Postal Service explained in its initial comments, "Proposal Two relies on demonstrably weak econometrics: time series regressions using a single explanatory variable and only eight data points." USPS Comments at 2. On a conceptual level, Dr. Neels' rote acceptance of his data lacks "any meaningful consideration of the actual nature of the costs within those components, or serious consideration of whether his

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competitive advantages and disadvantages to competitive products. However, an increase in competitive products' relative weight – say, from 5 percent to 15 percent – would equally affect both the "advantage" and "disadvantage" sides of the equation. The FTC's central finding of a net competitive disadvantage would remain unchanged; if anything, the larger allocation ratio would only increase the size of the net disadvantage in absolute-dollar terms.

[5] In the general context of "level playing field" issues, the Postal Service would like to take this opportunity to clarify an aspect of its initial comments. At that time, the Postal Service had understood that the Commission estimated the mailbox monopoly's value on the basis of certain product volumes that the Commission's consultants originally deemed to be "contestable," and footnotes 38 and 40 of the Postal Service's initial comments reflect this understanding. However, the Commission's subsequent annual reports suggest – without explanation –material shifts in the range of relevant products. *Compare* Postal Regulatory Comm'n, Report on Universal Postal Service and the Postal Monopoly (2008), at 149 (Periodicals, Standard Mail Enhanced Carrier Route (ECR), and Parcel Post), *with* Postal Regulatory Comm'n, Annual Report to the President and Congress, Fiscal Year 2012 (Jan. 3, 2013), at 40 fn.7 (Periodicals, Standard Mail Letters, Flats, and Parcels, and Parcel Post), *and* Postal Regulatory Comm'n, Annual Report to the President and Congress, Fiscal Year 2015 (Jan. 6, 2016), at 48-49 (Periodicals, Standard Mail ECR, and Parcel Select). It might still be true that the bulk of Parcel Select volume and of overall competitive product volume are irrelevant to the mailbox monopoly, but the Commission's FY2015 annual report does not clearly support the last two sentences of footnote 38 or the last sentence of footnote 40 of the Postal Service's initial comments. This uncertainty does not affect the validity of each footnote's main point, however: the Commission has never considered Priority Mail volumes – UPS's focus – to factor into valuation of the mailbox monopoly, and the alternative (UPS-sponsored) estimate that UPS invokes fails to account for the fact that UPS and other private carrier-customers share in any mailbox monopoly benefits that inure to Parcel Select.

results are consistent with the real-world activities that caused those costs to be accrued." *Id.* at 2-3. As such, Proposal Two "come[s] nowhere near reaching the level of support necessary to justify wholesale abandonment of key theoretical and empirical findings developed and refined over many years." *Id.* at 3-4.

Insofar as other commenters analyze Proposal Two, they unanimously agree with the Postal Service that the Commission cannot accept Proposal Two, due to its fatally flawed model. ACMA Comments at 40-44; Amazon Comments at 3, 19-22, 102-114; Mailers Comments at 3-4, 13-14; Public Representative Comments at 3, 36-41.[6] To the extent that the other comments point out flaws that might not be explicitly apparent from the Postal Service's initial comments, the Postal Service agrees with and incorporates those criticisms as well. *See* Amazon Comments at 20-22, 109-111, 113-14 (explaining the "one-sided and selective nature of [Dr. Neels's] analysis," insofar as he arbitrarily discards inconvenient regression results and fails to examine whether his approach yields "hidden fixed" as well as "hidden variable" costs).

B. Not Even Valpak and NPPC, Which Share UPS's General Goal of Greater Cost Attribution, Offer Serious Support for UPS's Specific Proposals.

Valpak and NPPC use Proposals One and Two as an opportunity to register the alignment between their own interests in greater cost attribution for market dominant products, as a general proposition, and the results that they believe UPS's proposals would have. However, they stop short of offering a reasoned endorsement for the

[6] PSA does not specifically discuss Proposal Two in its separate comments, but PSA is a co-sponsor of the Mailers Comments.

merits of those proposals. Indeed, NPPC explicitly "takes no position on" the methodologies reflected in Proposals One and Two. NPPC Comments at 3.

Valpak's comments are more qualified, but they likewise lend no clear support to UPS's specific recommendations. Valpak expressly declines to discuss Proposal Two, and it complains that "UPS'[s] failure to address market dominant products in any meaningful way makes it difficult to understand how [Proposal One] would operate to affect cost distribution among products, to say nothing of pricing." Valpak Comments at 2, 4. Valpak goes on to discuss the consequences of adopting Proposal One, without taking sides on its likely "hotly contested" "appropriateness." *Id.* at 16. Even Valpak's few supportive remarks about Shapley-values-based cost allocation are so tentative as to suggest a lack of actual analysis. *Id.* at 12 fn.10 (characterizing UPS's proposal as "an interesting suggestion" that "could be a more rational way to recover [common or joint] costs" (emphasis added)). Although Valpak asserts that "the cost methodology incorporated in UPS Proposal One also appears to meet the economic standard for causality," *id.* at 20, Valpak's comments contain no principled explanation of how Valpak reached this conclusion. As such, they cannot be read to offer a serious rationale for why Proposal One (much less Proposal Two) meets the statutory "reliable-causation" standard.

II. THE PUBLIC REPRESENTATIVE IS MISTAKEN IN BELIEVING THAT PROPOSAL ONE MEETS THE "RELIABLE-CAUSATION" STANDARD

The Public Representative apparently supports Proposal One and the arbitrary allocation of inframarginal costs to products. However, the Public Representative's justifications show that his support is predicated upon serious misconceptions of how the established methodology for measuring marginal cost actually works, as well as

upon a failure to apply the economics of the multiproduct firm to the Postal Service. The Public Representative's presentation of postal costing is woefully inadequate and demonstrably incorrect, and this leads the Public Representative to err in his attempted justification of UPS Proposal One. These points are discussed in this section, and the Appendix to these Comments contains the supporting mathematical demonstrations. Once these deficiencies are corrected, all of the Public Representative's justifications for Proposal One disappear. Moreover, the Public Representative's overall position on Proposal One would produce a paradoxical outcome in light of the original petition in this proceeding.

A. The Public Representative's Comments Betray a Fundamental Misunderstanding of the Established Costing Methodology, the Economics of Multiproduct Firms, and Causation-Based Development of Attributable Costs.

1. The Public Representative's characterization of the established costing methodology is erroneous.

In his attempt to describe the established methodology for calculating marginal costs, the Public Representative asserts that the calculations are based upon three assumptions. In reality, however, none of the three asserted assumptions are actually required for calculating marginal cost in the established methodology. The Public Representative's assertions to the contrary are in error, both conceptually and mathematically. These erroneous assertions bespeak confusion about how the Postal Service and the Commission calculate marginal costs, and this confusion is partially responsible for the Public Representative's misplaced conclusion that inframarginal costs are causally linked to individual products.

Consider the first asserted assumption. The Public Representative claims that the established methodology depends upon an assumption that the "variability" or

"elasticity" of each cost component is constant:

> In order to develop marginal costs from component costs, several assumptions are required. First, it is necessary to treat each component as if it were a cost function, and assume that the elasticity of the cost function of each component is constant, namely that elasticity did not change as volume changed.

Public Representative Comments at 22 (emphasis added).

This assertion is factually incorrect. Many cost components have underlying functions that necessarily have non-constant elasticities. As demonstrated in the Appendix, functions such as the translog function used for the highway transportation or the quadratic function used for city carrier street time have elasticities that change as volume changes. The mathematical explanation provided in the Appendix to this document clearly shows that the elasticity is not constant with respect to volume, but rather changes as volume changes.[7]

As for the Public Representative's second asserted assumption, the Public Representative claims that, "just as each component-level elasticity is assumed to be constant at all levels of production, each component's marginal cost is also assumed to be constant at all levels of production." *See* Public Representative Comments at 22. As shown in the Appendix, however, except for a special case where elasticity is equal to 100 percent, the Public Representative's asserted condition is a mathematical

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[7] To be sure, the Postal Service currently assumes that the elasticity of a component is constant with respect to volume in calculating incremental cost. This assumption was made to ensure that the calculation of incremental costs did not depend upon a potentially controversial underlying equation and to ensure that the calculation of incremental costs could be made for a test year in a way that was consistent with the roll-forward (cost forecasting) model. *See* Direct Testimony of Michael D. Bradley on Behalf of United States Postal Service, USPS-T-22, PRC Docket No. R2000-1 (Jan. 12, 2000), at 24. However, the incremental cost model is not used to calculate marginal costs. In that context, the relevant model is the attributable cost model, which, in the form of the Cost and Revenue Analysis Report (CRA), does not assume constant elasticity.

impossibility.

Apart from mathematical proofs, basic logic demonstrates the Public Representative's fallacy. If marginal costs were constant with respect to volume, then the entire basis for Proposition One would disappear, because there would be no inframarginal costs. Recall that inframarginal costs arise because the marginal cost of a particular unit of volume will be greater than the marginal cost of the last unit of volume. If marginal cost is constant across all units of volume (or across the cost driver), then the marginal costs at all levels of volume are identical, and no inframarginal costs exist.[8]

The third claimed assumption by the Public Representative relates to what is known as the "distribution" step of the established method for calculating marginal cost.[9] The Public Representative comes up with an unusual – and mistaken – interpretation of that step. The Public Representative is apparently under the misconception that the distribution step somehow "allocates" economies of scale and scope to individual products. *See* Public Representative Comments at 22 ("Another key assumption underlying the currently accepted attribution method is that the share of a product's volume, or some other cost driver, may be used to allocate marginal costs to products such that the economies of scale and scope contained within a component are equitably shared among products."). The Public Representative provides no mathematical basis

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[8] The Public Representative also erroneously argues that "[t]hese assumptions allow the total marginal cost of a component to be determined by multiplying the elasticity of that component by the accrued cost of each component." *Id.* at 22. This is not the case. Total marginal cost is defined by the product of the marginal cost of the last unit times the total volume of the product, but does not require an assumption of constant marginal cost. In fact, as shown above, if a component's marginal cost were constant, then the component's volume variable cost would equal its total cost.

[9] *See* United States Postal Serv., Calculating Postal Product Costs: Marginal Costs, at 4-5, *filed as* Summary Description of USPS Development of Costs by Segments and Components, Fiscal Year 2014 (July 1, 2015), Appendix H.

or economic model to support this claim. Indeed, there is no mathematical basis for this mistaken assertion, and no economic model exists which has this result.

In a footnote, the Public Representative attempts to provide some justification for its assertion:

> Using distribution keys is a cost allocation method, because it allocates joint and common component-level costs caused by the production of many products, to individual products. Even though the Commission has not generally supported the allocation of joint and common costs, it has accepted using distribution keys because, even though one cannot determine the share of common, component-level costs caused by individual products using distribution keys, using distribution keys assumes the proper allocation of joint and common component-level costs is achieved.

Id. at 22 fn.36. However, marginal cost is not the result of an allocation of "joint and common" costs.[10] Rather, marginal cost is a measure of how much total cost changes as the volume of a product changes. In particular, in a multiproduct firm, marginal cost is a measure of how much more cost, possibly including some common cost, arises from the production of additional amounts of the product. Contrary to the Public Representative's depiction, the attribution of common costs to individual products is not an arbitrary "allocation." To the extent that common costs exist, marginal cost measures how much those common costs increase due to additional units of output.

Consider a studio that a painter and a potter share. Now consider the air

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[10] It is telling that the Public Representative uses the terms "joint and common costs" as if the terms are interchangeable. In general, they are not, and they have different implications for cost attribution. *See* Michael D. Bradley, Analysis of UPS Proposals One and Two, and the Supporting Report of Dr. Kevin Neels [hereinafter "Bradley Report"], at 7 fn.6 ("The consensus, however, is that the term 'joint costs' is reserved for the subset of common costs in which the outputs are produced in fixed proportions. Defined this way, joint costs are not generally applicable to the Postal Service."), *filed with* Initial Comments of the United States Postal Service on UPS Proposals One and Two, PRC Docket No. RM2016-2 (Jan. 27, 2016).

conditioning required for cooling the studio. In general, one would think the cost of the air conditioning to be a common cost because it arises if either, or both, of the products are provided. But there could be an increase in the common costs from additional units of one output but not the other. For example, if the potter had to run a kiln for each piece produced and running the kiln increased the heat in the studio, there could be additional air conditioning costs whenever a piece of pottery was produced. Although there is no arbitrary allocation of common costs, the marginal cost of a piece of pottery could include the additional air conditioning cost caused by its production.

This is how the established methodology works. It measures the increase (or decrease) in a component's cost associated with the provision of additional (or fewer) units of volume. In some instances, the rate of increase will be the same across products if, indeed, all products create the same increase in costs. But in other instances, like carrier delivery costs, the rates of increase in cost are different because different shapes of mail have different impacts on cost.[11]

Just as marginal cost does not embody an arbitrary allocation of common costs to products, neither does unit volume variable cost. The Public Representative is perhaps misinterpreting the homogeneity assumption, discussed in the Appendix, as an arbitrary allocation, because the distribution step involves the ratio of the product-specific amount of the driver to the total amount of the driver. However, use of that ratio permits capturing the rate at which the amount of the driver changes when the associated product's volume changes.

[11] To facilitate understanding of the costing process, a walkthrough of the existing methodology is provided in the Appendix. It shows that the calculation of marginal cost does not require the "allocation" of joint and common costs.

For example, in city carrier delivery time cost, the cost drivers are the various shapes of mail delivered on city carrier routes. Each piece of delivered volume has an antecedent in a piece of originating volume.[12] The cost driver ratio simply measures the proportion of, say, single-piece First-Class Mail that is delivered as a letter or flat on city carrier routes. The driver-volume relationship is causal, not arbitrary. Contrary to the Public Representative's claim, the Commission's methodology is a true distribution, not an arbitrary allocation.

Finally, the Public Representative is in error when he claims that an assumption about the distribution of joint and common costs is what allows the marginal component costs for each product to be summed across components in order to find the overall marginal cost. Public Representative Comments at 22. The ability to add marginal costs across components has nothing to do with the distribution of costs within individual components. Rather, it is dependent upon the separability of costs across components.

Economically, separability means that one calculates the increase in, say, delivery costs caused by an increase in volume, without simultaneously accounting for any increase in costs that may occur in mail processing or transportation. Mathematically, it means that the derivative of cost with respect to volume in one component is not influenced by the level of volume or cost in other components. For example, separability arises if the total cost function for the Postal Service is just the

[12] Originating volume is sometimes referred to as "RPW" volume in reference to the Postal Service's Revenue, Pieces, and Weight data system.

sum of the individual component cost functions.[13]

A valid evaluation of UPS Proposal One requires an accurate understanding of how the current methodology, used by the Commission and the Postal Service, works. Various errors in the Public Representative's comments indicate that his support for Proposal One is based on a misunderstanding of how the established costing methodology actually works. As such, the Public Representative's endorsement is of no moment.

2. The Public Representative's misstatements about the costing system suggest a misunderstanding of both the costing process and the economics of multiproduct firms.

The following statement suggests the degree to which the Public Representative fails to understand the established costing methodology:

> Because the current methodology applies component-level elasticity to the entire postal volume, it establishes a constant marginal cost for each component. The volume variable, or marginal cost of a product, is then achieved by allocating component-level marginal costs to individual products, and then summing across components for each product. This is so product-level variable costs will decline so long as the component is experiencing economies of scale or scope. When the volume-related decline ends, variable costs will equal marginal costs, but at all prior volumes, product-level variable costs will be greater than volume variable or marginal costs.

Id. at 23. Every sentence in this statement appears to contain at least one serious error and/or mischaracterization of the nature of costs. It is difficult to tell whether this is the result of a true misunderstanding on the part of the Public Representative, or just inelegant phrasing, but because the statement is at the heart of his support for Proposal One, it bears review.

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[13] A description of separability and its implications are provided in the Appendix.

The first sentence starts with the premise that "the current methodology applies component-level elasticity to the entire postal volume." However, it is well-known that a component's elasticity is applied not to volume, but to cost.[14] Second, even if volume were to be multiplied by cost, it would not be multiplied by the "entire postal volume," but rather by the volume (or cost driver) associated with the individual component. For example, rural carrier costs are associated with rural carrier volumes, not the entire Postal Service volume, which includes mail delivered on city routes and post office boxes. The first sentence then claims that the established methodology "establishes a constant marginal cost for each component." As demonstrated above, however, the established methodology does not imply a constant marginal cost in each component. If it did, there would be no inframarginal costs and no premise for Proposal One.

The second sentence equates volume variable cost and marginal cost. The two are not equal. A product's volume variable cost is calculated using the entire number of units across the products' entire range of its volume or cost driver. Thus, it is not the same thing as a marginal cost, which is the additional cost from adding a unit of the product.[15] The sentence goes on to state that a product's marginal cost is found by "allocating component-level marginal costs to individual products, and then summing across components for each product." Yet the methodology does not "allocate" marginal costs to products; rather, it distributes volume variable costs to products as a step in

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[14] Recall that a component's volume variable cost is found by multiplying the component's accrued cost by the component's elasticity. That is:

$$TVVC_j = \varepsilon_j C_j$$

[15] Perhaps the Public Representative meant to equate marginal cost to unit volume variable cost, which is valid.

calculating component-level marginal cost. The component-level marginal costs are then added, by product, across components.

The third sentence states, "This is so product-level variable costs will decline so long as the component is experiencing economies of scale or scope." As written, this sentence suggests confusion about the effect of economies of scope on variable costs. Variable costs always increase with volume; economies of scale or scope do not make variable costs decline. Instead, economies of scale cause variable costs to increase less quickly as volume increases.[16] The Public Representative would have been correct if he had said that the rate of increase in variable costs declines as volume increases.

The paragraph concludes, "When the volume-related decline ends, variable costs will equal marginal costs, but at all prior volumes, product-level variable costs will be greater than volume variable or marginal costs." This sentence also exhibits a confusion with respect to the relevant cost concepts. A correct statement would be that unit volume variable cost equals marginal cost at the current volume level, but at lower amounts of volume, the marginal cost per unit will be higher. Unless only one unit is produced, variable costs will never equal marginal costs, as variable cost is a "total" measure and marginal cost is a "unit" measure.

Whether these inaccurate statements are conceptual mistakes or simply slopping drafting, the Public Representative compounds the problem by mistakenly arguing that the established methodology relies upon an assumption that delivery costs are the same regardless of the level of volume or year in which they are delivered. Public

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[16] This mistake does not appear to simply be a failure in written communication. Figure 1 in the Public Representative's Comments presents a graph that features variable costs declining as volume increases.

Representative Comments at 25 ("Limiting attribution to marginal cost is based on the faulty assumption that the cost of delivering any volume of mail is the same, regardless of the level of volume produced and delivered each year."). Contrary to this claim, the established methodology does not assume the cost of delivering any volume of mail is heedless to volume or year changes. The established methodology measures accrued costs every year, and if there is a change in carrier wages or delivered volume, the accrued costs will reflect that change. Similarly, if the delivered volume for a particular product falls, everything else equal, its delivery costs will fall. This will be reflected in both lower accrued delivery cost and lower volume variable cost for the product.

These types of errors are further compounded when the Public Representative attempts to explain his reasoning through Figure 1. *Id.* at 24. Both the graph and the Public Representative's underlying narrative contain errors. These errors are serious enough to suggest the Public Representative is not appropriately applying the correct costing concepts to a multiproduct firm such as the Postal Service. The apparent failure is addressed in detail in the Appendix.

Because the Postal Service is a multiproduct firm, valid evaluation of both the established methodology and proposed methodological changes must be performed within the economics of a multiproduct firm. The Public Representative's analysis fails to achieve this basic goal.

3. The Public Representative's misapprehensions lead to the fallacious conclusion that inframarginal costs must be causally related to products simply because that is true of volume variable costs.

The Public Representative's argument for why inframarginal costs should be distributed to products is simple: if the established methodology appropriately distributes

volume variable costs to products, then it must be appropriate to distribute inframarginal costs to products in the same manner. For all its seductive simplicity, this argument fails to recognize that there is a fundamental difference between the two types of costs. Volume variable costs are unquestionably caused by individual products, while inframarginal costs are often not. Moreover, the mistaken appeal of this argument arises from applying a simple analytical structure to a complex situation.

Both UPS and the Public Representative mistakenly apply the economics of a single-product firm to the Postal Service, which is a multiproduct firm. This fundamental mistake leads to incorrect assertions about the appropriate cost measures and cost attribution methodologies that should be used. For example, the Public Representative complains that "[o]nly a subset of variable cost, volume variable cost, is attributed to products under the currently accepted methodology," "even though variable costs are directly tied to the level of production." *Id.* at 25. It is only in a single-product firm, however, that all variable costs should be attributed to products. Not all variable costs should be attributed to products in multiproduct firms, due to the existence of common costs and economies of scope. Bradley Report at 8. Only those variable costs that are actually caused by products should be attributed to them. This is just what is done in the established methodology, which only attributes to a product those costs that were caused by the product. As should be done in a multiproduct firm, the established methodology measures the change in variable cost caused by a change in the volume of an individual product. If the cost-causing volume change is one or more, but fewer than all, units of the product, then the established methodology produces marginal cost. If the cost-causing volume change is all of a product's volume, then the established

methodology produces incremental cost.

The key point is that there is no arbitrary allocation of common costs. Only the change in common cost, to the extent it exists and is associated with a change in a product's volume, is attributed to a product. The Public Representative's misapprehension of this essential characteristic of the economics of multiproduct firms causes him to mistakenly claim that the established methodology "perfectly allocates" common costs to individual products:

> Moreover, although volume variable costs are distributed to each product, the volume variable cost of each product is caused, not solely caused, by that product. The current methodology is more complicated and requires the assumption that each cost driver linked to every product, within a component, causes identical costs to be incurred by the component or activity[.]

Id. at 25-26.

As explained above, this assertion ignores the fact that, in the established methodology, the attribution of costs to products follows the true causal relationship between products and costs in a multiproduct firm. The established methodology does not contain an assumption that each cost driver is linked to every product. A cost driver is only linked to a product when a change in a product's volume leads to a change in the amount of the cost driver.[17] If a change in a product's volume leads to no change in the cost driver, then no linkage is created. For example, an increase in the volume of drop-shipped products does not necessarily cause an increase in inter-facility transportation costs. It is therefore not reasonable to link these two variables.

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[17] Note that there could also be a change in the cost driver for reasons other than volume changes. For example, if the average weight or cubic size of a product changes, then the amount of transportation it requires could also change.

The Public Representative's misunderstanding of the key difference between volume variable costs and inframarginal costs then leads him to make the following claim:

> The accepted methodology limits the application of the distribution key to allocation of component level costs to volume variable costs. The remaining component variable cost, inframarginal cost, is treated as a component of institutional cost. However, the same rationale used to justify attributing component-level volume variable costs to products can be applied to inframarginal cost. Although inframarginal component costs include joint and common costs, so do volume variable component costs.

Id. at 26 (footnote omitted). It is a mistake to say that the same rationale that is used to attribute volume variable costs to products can also be used to justify attributing inframarginal costs to products. The true rationale for attributing volume variable costs to products is that attribution is an intermediate step in calculating a *bona fide* cost measure: marginal cost. There is not a *bona fide* cost measure associated with arbitrarily allocating inframarginal costs to individual products.[18] The resulting costs would have no economic meaning and would provide misleading costing signals to the multiproduct firm.

Nor is there anything in the established methodology that suggests that, as a general matter, "joint and common costs have been removed from volume variable costs." *Id.* To be sure, the established methodology explicitly removes unrelated common costs when calculating the volume variable costs attributed to products. It does this by measuring the change in variable costs associated with changes in individual product volumes. Only the changes in common costs caused by changes in volumes of

[18] The portion of inframarginal costs caused by individual products is appropriately included in those products' incremental costs. The Public Representative is proposing going beyond this appropriate inclusion and allocating all inframarginal costs in the attributable costs that are used for pricing purposes.

individual products are included in those products' volume variable costs. If the change in a product's volume does not lead to a change in a component cost, then no volume variable cost from that component will be attributed to individual products. In this way, the established methodology follows a clear and unambiguous causal linkage.

The Public Representative attempts to justify its claim that volume variable costs include common costs by asserting that this result arises because volume variable costs in a component can be expressed by the product of the component's accrued cost and its elasticity. *Id.* A review of the mathematics underlying that formulation, however, shows that it implies exactly the opposite of the Public Representative's assertion. As demonstrated in the Appendix, when a component's accrued costs are multiplied by its elasticity to calculate the volume variable costs, the only costs that are attributed to a product are the change in costs associated with the product's change in volume.

Contrary to the Public Representative's mistaken claim, a correct examination of the math unambiguously shows that the established methodology for determining marginal costs for a product strips out any common costs not caused by that product. Thus, there is a fundamental difference between volume variable costs and inframarginal costs. Inframarginal costs include general common costs, and volume variable costs do not. This critical difference is why it is appropriate to attribute volume variable costs, but not inframarginal costs, to individual products.[19]

In an effort to shore up his misunderstandings, the Public Representative claims that the Postal Service's Office of the Inspector General (OIG) supports distributing all

[19] Again, the Public Representative's claim is confined to the calculation of attributable costs. Inclusion of the relevant portion of inframarginal costs is appropriate when calculating a product's incremental costs, which serve a different purpose.

inframarginal costs to products. *Id.* at 26-27. However, the Public Representative fails to mention that the OIG report discusses inframarginal costs only in the context of the current methodology for calculating a product's incremental cost.[20] On the same page as the quotation that the Public Representative cites, the OIG report explicitly states:

> There is a second very important question that the Postal Service cost system was designed to answer: What is the total cost caused by the product — in other words, what costs would not exist if the product did not exist? The tool used for this purpose is called incremental cost.

United States Postal Service Office of Inspector General, RARC-WP-12-008, Primer on Postal Costing Issues (Mar. 20, 2012), at 22 (emphasis added).

This quotation shows that the "total" cost to which the OIG is referring is incremental cost, not the arbitrary distribution of all inframarginal costs to products. In fact, contrary to the Public Representative's false claim, the OIG does not endorse the wholesale distribution of inframarginal costs to products in the context of attributable cost. If anything, the OIG has a clear sense of the pitfalls of fully-distributed costing methods like UPS's Proposal One.

> Fully-distributed cost (FDC) methods that allocate institutional costs to products may be misleading indicators of a product's financial performance. . . .
>
> However, the problem with FDC is that institutional costs by definition are not caused by any product. Therefore, any method used to allocate institutional costs to products is by its very nature arbitrary. FDC neither reflects cost-causing activities nor the demand characteristics of the product. And the choice of allocation method can lead to significantly different results, including whether or not it appears that a product is making or losing money. Therefore, the choice of allocation method can be misleading in evaluating the financial performance of a product line. And when used to develop prices, FDC can lead to prices that do not

[20] Indeed, the Public Representative's selected quote is from a section of the report entitled "Appendix B Incremental Costs."

> reflect the right economic signals.
>
> FDC does provide a price floor that ensures products make a significant contribution to fixed cost; however, the procedure introduces numerous distortions into the calculus of pricing. In that sense, the cure may be worse than the disease.

Id. at ii, 4.

By mistakenly applying the economics of a single-product firm to the Postal Service, the Public Representative jumps to the erroneous conclusion that if all volume variable costs are causally related to individual products, then all inframarginal cost must also be causally related to individual products. This simple leap of faith overlooks the critical difference between the two types of costs. Volume variable costs are unquestionably caused by individual products, while inframarginal costs are often not. In a multiproduct firm, the fact that inframarginal costs may be variable costs does not, by itself, imply a causal link to individual products. Inframarginal costs include general common costs, and volume variable costs do not. Consequently, except for their inclusion in products' incremental costs, inframarginal costs cannot be accurately attributed to individual products.

4. The Public Representative wrongly asserts that distribution keys can be used to accurately assign inframarginal costs to individual products.

The Public Representative relies on a similarly simplistic, but wrong, assumption that distribution keys can be used to accurately assign inframarginal costs, just as they do for volume variable costs. To support this assertion, the Public Representative claims that "because inframarginal and volume variable costs are both components of variable costs at every level of volume, they can be distributed in the identical manner by which volume variable costs are distributed." Public Representative Comments at 29 fn.40. This facile approach ignores the essential difference between volume variable costs and

inframarginal costs described in the previous section. Volume variable costs are caused by individual products and most inframarginal costs are not. Contrary to the Public Representative's claim, there is a very different rationale for distributing volume variable costs than for distributing all inframarginal costs. The former follows a causal path and produces a meaningful cost measurement, while the latter is arbitrary, non-causal, and produces an undefined and misleading cost measure.

Moreover, the Public Representative falsely claims that Professor Panzar supports the general attribution of inframarginal costs to products. *Id.* at 29. To the contrary, Professor Panzar supports attributing only the part of inframarginal costs that arise in individual products' incremental costs, consistent with the current methodology. This is very different from the distribution of all inframarginal costs to products using distribution keys. The Public Representative's quotation from Professor Panzar's paper omits the paragraph's crucial last sentence: "However, unless component marginal cost is constant, the resulting cost distribution to product *i* is not the amount of cost that would be avoided if product *i* were to be discontinued: i.e., it is not the incremental cost of product *i*." John C. Panzar, The Role of Costs for Postal Regulation (2014), at 13 (final emphasis added), http://www.prc.gov/sites/default/files/reports/J%20Panzar%20Final%20093014.pdf. Nor does the Public Representative present Professor Panzar's ultimate conclusion: "Attributable Costs as measured by the CRA have a serious shortcoming: they understate incremental costs – the economically relevant standard for testing rates for cross-subsidization. However, the CRA provides the necessary information to correct this shortcoming, allowing incremental costs to be readily calculated." *Id.* at 26.

Whatever possible ambiguity might have resided in Professor Panzar's 2014 paper, his declaration in this proceeding has clarified his emphatic rejection of the use of existing distribution keys to allocate inframarginal costs to products:

> **Infra-marginal Costs Can be Allocated to Products Using Existing Distribution Methods, but the Commission Should Not Do So!**
>
> UPS's arguments concerning the role of distribution keys in the Postal Service CRA betray a similar confusion. The UPS argument seems to be as follows: The Postal Service uses its distribution keys to distribute total component volume variable costs to obtain the component volume variable costs assigned to each product – therefore they must be causally valid. This means that using the same distribution keys to assign total component inframarginal [costs] to individual products must also be causally valid.
>
> This reasoning ignores the difference between the purposes of the distribution keys in the CRA versus UPS Proposal One. If (i) the distribution keys are valid; and (ii) the component variability factor is correct; then, the volume variable costs assigned to each service will be exactly equal to the marginal cost of that service multiplied by the quantity of that service. This means that the per unit volume variable cost of a service provides an accurate measure of the marginal *cost* of that service. This is why the distribution of component volume variable costs to each service is very useful. Marginal cost is a very important piece of information for firm decision making.
>
> The use of distribution keys to estimate incremental costs stands on a very different footing. Applying a distribution key to the total variable costs of a cost component used to supply multiple outputs does not directly measure the cost that would be avoided if *all* the units of any one (or several) of those outputs were eliminated. Indeed, as I explained in my 2014 report to the Commission, cost distribution keys cannot directly establish cost causality[.]

Declaration of John C. Panzar on Behalf of Amazon Fulfillment Services, Inc., PRC Docket No. RM2016-2 (refiled Jan. 29, 2016) [hereinafter "Panzar Declaration"], at 15-16.

Finally, the Public Representative's proffered mathematical framework also exposes his fallacies. On page 30 of his comments, the Public Representative attempts to show that inframarginal costs can be distributed to individual products in the exact

same manner as volume variable costs. In his presentation, the Public Representative fails to derive a condition that justifies distributing inframarginal costs and, instead, simply assumes that one can accurately do so.[21] In fact, as demonstrated in the Appendix, this is only true in the special case that a component's elasticity is equal to 100 percent. In such a case, however, there would be no need to distribute the component's inframarginal costs, because there would be not be any. As explained above, the Public Representative confuses the "distribution" step in the marginal cost methodology and erroneously believes that it represents an allocation of common costs across products. In reality, a product's marginal cost measures the increase in common cost associated with provision of one more unit of a product, and the established methodology measures that increase.

Just as the calculation of a product's marginal cost does not involve an allocation of common costs, the correct calculation of inframarginal cost does not involve an allocation of common costs across products.[22] A product's incremental cost measures the total costs associated with all units of that product and thus requires valuing each unit at its own marginal cost. Total volume variable cost, which is used to calculate marginal cost, values each unit at the marginal cost of the last unit. The difference between incremental cost and total volume variable cost is the product's inframarginal cost. A formal explanation is provided in the Appendix.

The previous section made clear that the Public Representative errs in arguing

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[21] The Public Representative also fails to provide a citation to an established economic model that supports such a distribution.

[22] This mistake also plagues Dr.Neels's analysis. *See* Bradley Report at 29.

that inframarginal costs can be accurately attributed to individual products. This section, mathematically supported in the Appendix, demonstrates that the Public Representative compounds that error by further asserting that existing distribution keys could be reliably used to accomplish that attribution. This false assertion presupposes a linkage, which does not exist, between the amounts of a component's cost driver used by individual products and the component's total inframarginal costs. Moreover, the Public Representative backfires in his attempt at a mathematical justification for the use of the cost driver. When the math is corrected, the attempted justification actually shows that the Public Representative's proposed approach does not produce product-specific inframarginal costs.

B. The Public Representative Mischaracterizes Postal Rate Commission Precedent.

The Public Representative attempts to justify the attribution of inframarginal costs to products on the basis that, in the past, costs other than volume variable costs have been allocated to Postal Service products. The specific instance cited by the Public Representative is the assignment of single subclass access costs to products in Dockets R90-1 and R94-1. Public Representative Comments at 13. However, the Public Representative's discussion of the issue is incomplete, and the analogy to the proposed attribution of inframarginal costs in UPS Proposal One is flawed for multiple reasons.

First, the Postal Rate Commission's decision to attribute single subclass stop costs to products was based upon causality. Opinion and Recommended Decision on Remand, PRC Docket No. R90-1 (Sept. 27, 1994) [hereinafter "R90-1 Remand Opinion"], at 45, 51. In contrast, inframarginal costs (beyond those included in

individual products' incremental costs) are common costs and are not causally related to individual products. Given that the governing statute requires cost attribution to be based on "reliably identified causal relationships," *see* 39 U.S.C. §§ 3622(c)(2), 3631(b), 3633(a)(2), these inframarginal costs should not be attributed to individual products. The fact that the Commission attributed causally-related single subclass costs to products in no way justifies attributing non-causally-related inframarginal costs to products.

Second, the Public Representative fails to mention that the Commission did not add single subclass access costs to volume variable access costs in calculating attributable costs. *Id.* at 48-51; *see also* Opinion and Recommended Decision, PRC Docket No. R94-1 (Nov. 30, 1994) [hereinafter "R94-1 Opinion"], at III-45. This stands in direct contrast to UPS's Proposal One, which proposes attributing inframarginal costs on top of volume variable costs. Moreover, the Commission recognized that a difficulty in attributing multiple subclass costs arises because of the commonality of those costs. R94-1 Opinion at III-45-46 ("As in the R90-1 Remand, the Commission recognizes that under the marginal hypothesis traditionally employed by economists, in which the volume of one service changes while the volume of all other services are held constant, the 'causes' of the need to access a multiple subclass stop may be unidentifiable."); R90-1 Remand Opinion at 51. The fact that many inframarginal costs are also common means that there is not a causal link between individual products and those costs, and so they should not be attributed.

Third, contrary to the implication by the Public Representative, both the Postal Service and the Commission found a causal link between the costs of single subclass

stops and the products that gave rise to them. The two parties differed insofar as the Postal Service recognized that these costs do not vary at the margin and are appropriately included in the incremental cost of the relevant products. The Commission disagreed and included the costs for single subclass stops in the attributable cost for products, in part, because the Postal Service had not yet calculated incremental costs for products at that time. R90-1 Remand Opinion at 54. In the context of this proceeding, the Postal Service and Commission's point of agreement in Docket No. R90-1 is more relevant than their point of disagreement. Costs should be included in a product's marginal or incremental cost only when there is a valid causal link between the product and the costs; the statute requires no less. When there is such a valid link for inframarginal costs, then attribution may be warranted. Otherwise, as in UPS's Proposal One, it is not.

C. The Public Representative's Position on Proposal One Would Produce a Paradoxical Result.

Taken as a whole, the Public Representative's comments would, if adopted by the Commission, yield a wholly paradoxical outcome for this proceeding. UPS's primary interest is in seeking changes that would increase the costs attributed to competitive products; those changes would logically increase market-dominant products' attributable costs as well, but that is not UPS's chief concern. Indeed, UPS bases its proposal on the (mistaken) assertion that "captive" market-dominant ratepayers are subsidizing competitive products. UPS Petition at 5. *But see* Postal Service Comments at 35-37; Amazon Comments at 13, 72-73; PSA Comments at 5-6.

By contrast, the Public Representative apparently urges the Commission to approve Proposal One for market-dominant products but not for competitive products at

this time. Public Representative Comments at 54. To the extent that this would eventually affect market-dominant pricing (such as in the wake of the impending regulatory review under 39 U.S.C. § 3622(d)(3)), it would only increase the prices for market-dominant products, and not those for competitive products. While UPS has not come close to justifying its proposal, it is highly questionable whether the Commission can go beyond rejecting that proposal and instead adopt an alternative proposal that would have the opposite effect from what the petitioner has sought.

III. VALPAK'S DISCUSSION OF REPLACING MARGINAL COSTS WITH INCREMENTAL COSTS SUFFERS FROM TWO FATAL FLAWS

While Valpak takes no position on UPS Proposal One, it uses its comments to discuss its view that adoption of Proposal One would imply the replacement of marginal costs with incremental costs. This discussion fails for two reasons. First, UPS Proposal One does not produce incremental costs. Second, even if Proposal One did produce incremental costs, they should not be used in place of marginal costs, as incremental costs and marginal costs are complements, not substitutes, in the costing process.

A. Contrary to Valpak's Claim, UPS Proposal One Does Not Produce Incremental Costs.

Valpak indicates that it believes that UPS Proposal One will produce incremental costs in a number of places in its comments. *E.g.*, Valpak Comments at 2 ("UPS, adopting McBride's methodology, computes incremental cost for each competitive product to include that product's share of so-called 'inframarginal' costs."); *id.* at 5 ("Second, a discussion of the effects of having cost attribution for market dominant products reflect all costs caused by each product, including inframarginal costs as proposed by UPS (*i.e.*, incremental costs rather than just marginal costs).").

However, it is quite clear that UPS Proposal One computes fully distributed

costs, not incremental costs. This fact was highlighted by both Professor Panzar and Professor Bradley. Panzar Declaration at 11 ("For the many cost components that are estimated with a constant cost elasticity function (i.e., which are estimated to have no fixed or start-up costs), UPS Proposal One would require that minimum prices cover the fully distributed cost ('FDC') of that component."); Bradley Report at 35 ("In other words, for the analyzed components, Dr. Neels's approach is actually a simple Fully Distributed Cost (FDC) allocation scheme based upon relative driver proportions.").

There is an essential difference between the two cost measures. Incremental costs have a causal basis, but fully distributed costs do not. As Amazon remarks, "Proposal One would return postal ratemaking to the pre-1970 era by jettisoning causation-based cost attribution in favor of fully distributed costs and other arbitrary cost allocations." Amazon Comments at 79.

It is true that incremental costs contain some inframarginal costs (the inframarginal costs actually caused by individual products), but UPS Proposal One mistakenly advocates the allocation of all inframarginal costs. Thus Valpak's claim that Proposal One will produce incremental costs is in error.

B. Incremental Costs Should Be Calculated in Addition to, Not in Place of, Marginal Costs.

A substantial portion of Valpak's comments address the implications of substituting incremental costs in place of marginal costs. For example, Valpak states that "[a] determination to replace marginal costs with incremental costs as the basis for cost attribution would offer a major break with the past, and give the Postal Service an opportunity to reappraise completely its pricing strategy." Valpak Comments at 15.

This quotation demonstrates that Valpak misunderstands the true relationship

between marginal costs and incremental costs. One is not a substitute for the other. If nothing else, the fact that the incremental cost for a given product is the sum of the marginal costs for all units produced reveals that the two costing concepts are not interchangeable. Moreover, marginal costs and incremental costs play different roles in providing cost information to a firm's decision-maker.

Marginal cost is the cost of the last unit produced:

> The concept of marginal cost plays a key role in the cost attribution procedure. Marginal cost, as we know, is the additional cost caused by the enlargement by one unit of the output of the service at issue. In other words, marginal cost is a direct measure of the variability of the total cost of the supplier under the influence of expanding output. One should consequently view volume variable costs – marginal costs multiplied by the number of units supplied – as a legitimate measure of the attributable cost of the service.

Direct Testimony of William J. Baumol on Behalf of the United States Postal Service, USPS-REM-T-1, PRC Docket No. R90-1 (June 23, 1994), at 5-6. Specifically, marginal cost (or its equivalent, volume variable cost per piece) is the cost measure that should be used when determining the prices that should be set:

> Economic analysis has long and repeatedly demonstrated that if the magnitudes of prices are to be selected in a way that elicits maximal contribution to the welfare of consumers from the supply of the products whose prices are in question, then marginal costs are the cost figures which must be used in the calculation process.

Direct Testimony of William J. Baumol on Behalf of the United States Postal Service, USPS-T-3, PRC Docket No. R87-1 (May 7, 1987), at 20. Because the marginal cost of a product measures the cost of producing the last unit of the product, it is the key cost datum necessary for determining prices that maximize consumer welfare. No other cost measure, including incremental cost, should be used in its place:

> That is, prices based on incremental costs, fully distributed costs or any other cost data not directly related to marginal costs will elicit input, output,

> organizational and purchase decisions which are not those that contribute maximally to economic welfare. The reason that is so is because, if prices are based on costs other than marginal costs, a purchaser of a service will pay a price for it that is unrelated to the cost that this purchase imposes, which is, by definition, its marginal cost.

Id. at 20-21 (footnote omitted).

This is not to say that incremental cost does not produce useful information for the firm. Incremental cost is also based upon the causal relationship between a product and total cost, in that it is the total cost created by the addition of all product's units to the firms output.

> The incremental cost of a service is the addition to the total cost of the enterprise that is caused when the enterprise supplies the current output of that service as compared to the total cost the enterprise would incur in all of its other operations if none of the service in question were supplied by it.

Id. at 22 (underlining omitted).

In this sense, incremental cost can also be thought of as being attributable to a product, but the role of incremental cost is very different from the role of marginal cost. Incremental cost should not be used as the basis for setting prices but rather as the basis for checking for cross-subsidy:

> The other idea that is important for pricing is incremental cost. Incremental cost is used to test whether or not a service's price entails a cross subsidy. The idea is simple. If the price of a service (or set of services) is such that the revenue that the sale of the service(s) bring in equals or exceeds the incremental cost of the service(s), then, clearly, there is no cross subsidy, because the revenue covers all of the cost caused to the firm by the service(s) in question.

USPS-REM-T-1 at 7-8.

In sum, marginal cost serves as the cost measure that should be used to set prices, and incremental cost serves as the cost measure that should be used to determine if a product's revenue exceeds its total cost. These two cost concepts are

clearly different, as are their roles in the cost process. They should therefore not be used interchangeably. Valpak is mistaken when it suggests that incremental costs could replace marginal (or volume variable) costs.

IV. CONCLUSION

Virtually all of the initial commenters agree: the Commission should reject both Proposal One and Proposal Two in their entirety. Even the two commenters who support the outcome of UPS's proposals abstain from taking a position on their legal sufficiency. The Public Representative's exceptional support for Proposal One (as applied to market-dominant products) rests on a number of flaws and deserves no weight. Therefore, the Commission should reject UPS's proposals.

Respectfully submitted,

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APPENDIX
TO REPLY COMMENTS OF THE UNITED STATES POSTAL SERVICE ON UPS PROPOSALS ONE AND TWO

This appendix contains mathematical demonstrations that a number of the Public Representative's assertions about both the established costing methodology and the applicability of UPS Proposal One are in error. The section headings in this appendix are the same as the associated sections in the main document to which the demonstrations apply.

II.A.1: Mathematical Demonstration That the Three Assumptions Asserted by the Public Representative to Be Required for Calculating Marginal Cost Are in Error.

In his attempt to describe the established methodology for calculating marginal costs, the Public Representative asserts that the calculations are based upon three assumptions. In reality, however, none of the three asserted assumptions are actually required for calculating marginal cost in the established methodology. Demonstrations to that effect are provided here for the first and second asserted assumption.

Consider the first asserted assumption. The Public Representative claims that the established methodology depends upon an assumption that the "variability" or "elasticity" of each cost component is constant:

> In order to develop marginal costs from component costs, several assumptions are required. First, it is necessary to treat each component as if it were a cost function, and assume that the elasticity of the cost function of each component is constant, namely that elasticity did not change as volume changed.

Public Representative Comments at 22 (emphasis added).

This assumption is demonstrably false, as many of the major cost components

have elasticities or variabilities which are not constant with volume. For example, the purchased highway transportation variability is developed from a transcendental logarithmic (translog) equation which does not have a constant elasticity with respect to volume.[1] To see this, consider the translog function, which has the following form:

$$\ln C = \alpha + \beta_1 \, lnV + \beta_2 \, lnV^2$$

The translog function has the following associated variability:

$$\varepsilon = \frac{\partial lnC}{\partial lnV} = \beta_1 + 2\beta_2 \, lnV.$$

This formula clearly shows that the elasticity is not constant with respect to volume, but rather changes as volume changes. Similarly, the city carrier street time elasticity is developed from a quadratic cost function which also does not have an elasticity which is constant with respect to volume.[2] The quadratic function is given by:

$$C = \delta + \gamma_1 V + \gamma_2 V^2$$

Its associated variability is given by:

$$\eta = \frac{\partial C}{\partial V}\frac{V}{C} = [\gamma_1 - 2\gamma_2 V]\frac{V}{C}$$

Again, this formula unambiguously demonstrates that the elasticity is not constant with respect to changes in volume. This proves the inaccuracy of the Public Representative's claim that the calculation of marginal cost requires a constant

[1] United States Postal Serv., Report on Updating the Cost-to-Capacity Variabilities for Purchased Highway Transportation, at 11-12, *filed as* Microsoft Word file "Rpt.Updat.PHT.Cost.Cap.Variab.docx", USPS-RM2014-6/1, PRC Docket No. RM2014-6 (June 20, 2014).

[2] United States Postal Serv., Report on the City Carrier Street Time Study, at 25-26, *filed as* Adobe Acrobat file "City Carrier Street Time Study Report.pdf", USPS-RM2015-7/1, PRC Docket No. RM2015-7 (Dec. 11, 2014).

component elasticity.

As for the Public Representative's second asserted assumption, the Public Representative claims that, "just as each component-level elasticity is assumed to be constant at all levels of production, each component's marginal cost is also assumed to be constant at all levels of production." *See* Public Representative Comments at 22. Apparently, the Public Representative does not realize that, except for a special case where elasticity is equal to 100 percent, the asserted condition is a mathematical impossibility.

To see this, consider that a component's elasticity is the product of its marginal cost and its volume-to-cost ratio:[3]

$$\varepsilon = \frac{\partial C}{\partial V}\frac{V}{C}.$$

The Public Representative asserts that <u>both</u> the elasticity and the marginal cost are constant with respect to changes in volume. To indicate their constancy, we will place a bar above the two terms which are assumed to be constant:

$$\bar{\varepsilon} = \left(\frac{\overline{\partial C}}{\partial V}\right)\frac{V}{C}$$

To determine the validity of the Public Representative's assertion, we can analyze what must happen in this equation in response to a volume change. Only volume and cost are free to vary, so we can examine what must happen to cost, when

[3] Note the same thing holds true if one substitutes a cost driver (D) for volume. Then the relevant elasticity would be given by:

$$\varepsilon = \frac{\partial C}{\partial D}\frac{D}{C}.$$

volume changes, if the equation is to hold and both the elasticity and marginal cost are constant. To do this, we can differentiate the equation with respect to a change in volume. Because the elasticity and marginal cost are assumed to be constant, their derivatives are necessarily zero. That is, by the constancy assumption:

$$\frac{\partial \varepsilon}{\partial V} = \frac{\partial \left(\frac{\partial C}{\partial V}\right)}{\partial V} = 0.$$

Differentiating the Public Representative's proposed elasticity expression with respect to volume yields:

$$0 = 0 + \left(\frac{\overline{\partial C}}{\partial V}\right)\left[\frac{C - \frac{\partial C}{\partial V}V}{C^2}\right].$$

From this expression we can see that for both of the Public Representative's assumptions to hold, then it must be the case that:

$$C - \frac{\partial C}{\partial V}V = 0.$$

This condition requires the total component cost to equal its volume variable cost, meaning that inframarginal cost is zero, by definition. This equation can be rearranged to provide perhaps a more intuitive condition:

$$\frac{\partial C}{C} = \frac{\partial V}{V}.$$

This is just the condition required for proportionality between cost and volume. This condition occurs only when the cost component's elasticity is 100 percent. Thus, the Public Representative's supposed assumptions hold only in the special case of 100-

percent variability.

To illustrate this important point, we examine the constant elasticity assumption that UPS and the Public Representative are espousing. The constant elasticity function has the following form:

$$C = \alpha V^{\beta}.$$

The associated elasticity is just β and the associated marginal cost is:

$$\frac{\partial C}{\partial V} = \beta \alpha V^{\beta-1}.$$

This equation shows that the marginal cost in the constant elasticity function depends upon the level of volume and is generally not constant with respect to changes in volume. That outcome will only occur in the special case in which β =1, the condition needed for 100 percent variability. Of course, 100 percent variability means that there would be no inframarginal costs to distribute, and Proposal One would be moot.

As there may be benefit to all parties understanding the established costing methodology, a walkthrough is provided here to clarify what assumptions do have to be made to measure marginal cost and to demonstrate that the calculation of marginal cost does not require the "allocation" of joint and common costs. To facilitate understanding of the costing process, we employ the constant elasticity function the Public Representative espouses. Moreover, in this application of the methodology, we will explicitly address the existence and role of the cost driver in the costing process. To simplify the algebra, assume there are only two products and identify those products as Product One and Product Two. Then, the total amount of the cost driver in the cost component, D_j, is found by summing the amounts of the cost driver required for each

product D_{1j} and D_{2j}:

$$D_j = \ D_{1j} + D_{2j}.$$

Then total component accrued cost, C_j, is given by:

$$C_j \ = \ \alpha_j\left(D_{1j} + D_{2j}\right)^{\beta_j}.$$

The marginal cost for, say, Product One is given by the change in component cost arising from a change in the amount of volume for Product One (V_1):

$$\frac{\partial C_j}{\partial V_1} = \ \frac{\partial\left[\alpha_j\left(D_{1j} + D_{2j}\right)^{\beta_j}\right]}{\partial V_1} = \ \beta_j\alpha_j\left(D_{1j} + D_{2j}\right)^{\beta_j - 1}\frac{\partial D_{1j}}{\partial V_1}.$$

We can now see how the established methodology calculates this marginal cost. The process starts with the "attribution" step which measures the total volume variable cost for the component, $TVVC_j$:

$$TVVC_j \ = \ \beta_j C_j \ = \ \beta_j\left[\alpha_j\left(D_{1j} + D_{2j}\right)^{\beta_j}\right].$$

This is followed by the "distribution" step which calculates total volume variable costs for the individual products, $TVVC_{1j}$ and $TVVC_{2j}$:

$$TVVC_{1j} \ = \ \ \beta_j\left[\alpha_j\left(D_{1j} + D_{2j}\right)^{\beta_j}\right]\frac{D_{1j}}{D_j}$$

$$TVVC_{2j} \ = \ \beta_j\left[\alpha_j\left(D_{1j} + D_{2j}\right)^{\beta_j}\right]\frac{D_{2j}}{D_j}.$$

Finally, these costs are divided by their respective product's volume to produce unit volume variable cost. For, the unit volume variable cost for Product One, $UVVC_{1j}$, is

given by:

$$UVVC_{1j} = \frac{\beta_j \left[\alpha_j \left(D_{1j} + D_{2j}\right)^{\beta_j}\right] \frac{D_{1j}}{D_j}}{V_1} = \beta_j \left[\alpha_j \left(D_{1j} + D_{2j}\right)^{\beta_j - 1}\right] \frac{D_{1j}}{V_1}.$$

Comparison of this expression with the expression for marginal cost presented above shows the actual assumption embodied in the established methodology. Unit volume variable cost equals marginal cost when:

$$\frac{\partial D_{1j}}{\partial V_1} = \frac{D_{1j}}{V_1} \text{ or } \frac{\partial D_{1j}}{D_{1j}} = \frac{\partial V_1}{V_1}.$$

This is the assumption that the driver is linearly homogenous in volume, so the driver increases in proportion to the increase in volume.

The Public Representative is in error when he claims that an assumption about the distribution of joint and common costs is what allows the marginal component costs for each product to be summed across components in order to find the overall marginal cost. Public Representative Comments at 22. The ability to add marginal costs across components has nothing to do with the distribution of costs within individual components. Rather, it is dependent upon the separability of costs across components.

Economically, separability means that one calculates the increase in, say, delivery costs caused by an increase in volume, without simultaneously accounting for any increase in costs that may occur in mail processing or transportation. Mathematically, it means that the derivative of cost with respect to volume in one component is not influenced by the level of volume or cost in other components. For example, separability arises if the total cost for the Postal Service is just the sum of the

individual component costs. Suppose there are *N* components. The total cost for the Postal Service is the sum of those component costs:

$$TC = C_1 + C_2 + C_3 + \ldots + C_N.$$

Under separability, the overall marginal cost is the sum of the component marginal costs. This means that the overall marginal cost with respect to a given product, such as Product A, is given by:

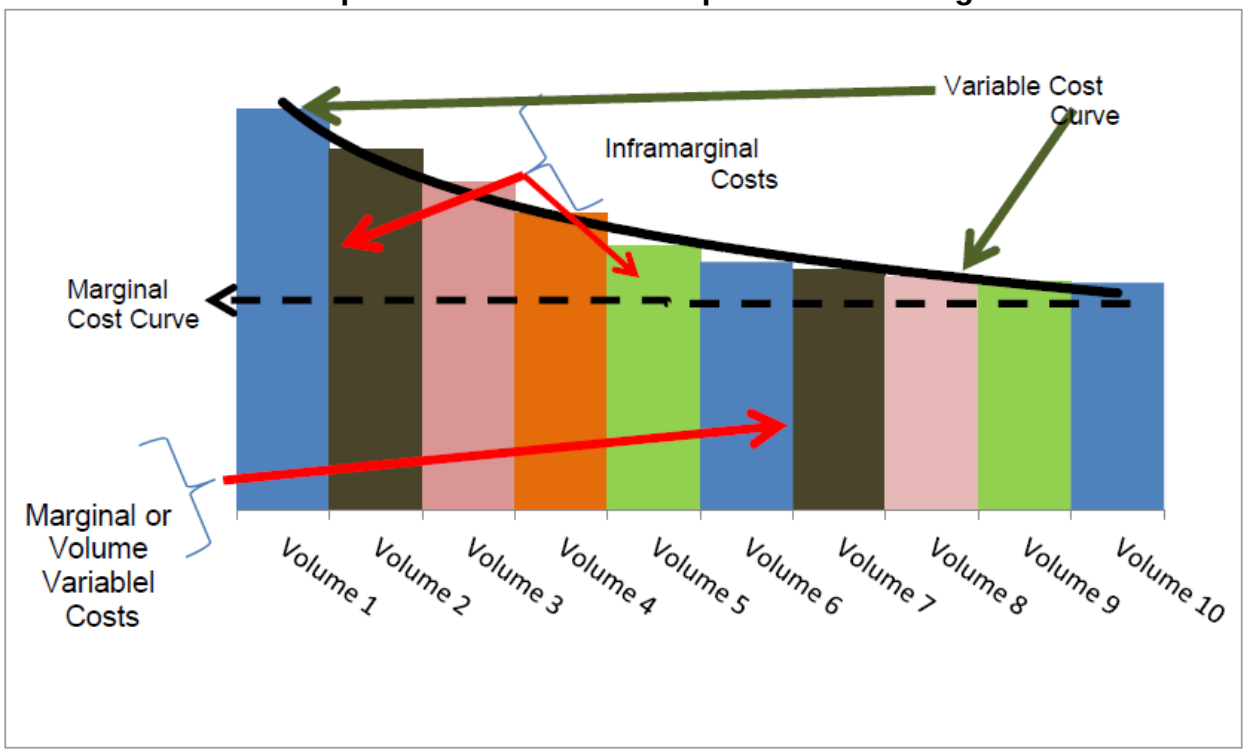
$$\frac{\partial TC}{\partial V_A} = \frac{\partial C_1}{\partial V_A} + \frac{\partial C_2}{\partial V_A} + \frac{\partial C_3}{\partial V_A} \ldots + \frac{\partial C_N}{\partial V_A}.$$

Clearly, this condition has nothing to do with the nature of the distribution step within individual components, as the Public Representative alleges.

II.A.2: Discussion of the Misstatements or Misconceptions Associated with the Public Representative's Figure 1.

The Public Representative attempts to explain his reasoning about the established methodology through Figure 1. *Id.* at 24. The graph and the Public Representative's underlying narrative included either misconceptions or misstatements about the methodology.

Figure 1
Reproduction of Public Representative's Figure 1



First, consider the Public Representative's graph. The line entitled the "Variable Cost Curve" actually measures the marginal cost associated with each additional unit of the driver, and so it should be labeled as the "Marginal Cost Curve." When drawn with a downward slope, it reflects economies of scale and density for a particular component. Second, it is not clear what the Public Representative means by the "Variable Cost Curve" label. If it is meant to be the traditional total variable cost curve, then the label is in error because total variable costs rise, not decline, with additional units of volume (or the cost driver). If it is meant to be the average variable cost curve, it is in error because no such measure exists in a multiproduct firm like the Postal Service. Compounding this labeling mistake is the additional mislabeling of the horizontal line as the "Marginal Cost Curve," which it is not. As explained above, the

Marginal Cost Curve is actually the downward sloping curve in the graph. Also, it is a mistake to label the area under the curve as "Marginal or Volume Variablel [sic] Costs, as those are two different cost concepts. Perhaps the Public Representative intended to refer to what is sometimes known as total marginal cost, which is the product of the marginal cost of the last unit times the total number of units. This area does equal volume variable cost, but it is different from marginal cost.[4]

The Public Representative's description of Figure 1 also contains unclear statements. For example, the Public Representative claims that the marginal cost is the area under what is designated as the marginal cost line. *Id.* at 23. In addition, the description repeats the confused statement that the inframarginal costs occur "only because the current method assumes that the elasticity is constant, the marginal component costs are constant, and the cost drivers equitably allocate component-level economies of scale and scope." *Id.* First, as explained in section II.A above, the current method does not make the three assumptions asserted by the Public Representative. Second, those assumptions are not necessary for the existence of inframarginal costs. One can easily describe a component cost function that exhibits both a non-constant variability and a non-constant marginal cost that includes inframarginal costs. It is only necessary that the component's elasticity be less than 100 percent.

II.A.3: Mathematical Demonstration Refuting the Claim That Volume Variable

[4] This is a distinction with a difference. To see this, consider the familiar measures from a single-product firm, total variable cost and average variable cost. These are very different measures of cost and should not be interchanged.

Costs Include Common Costs.

The Public Representative attempts to justify its claim that volume variable costs include common costs by asserting that this result arises because volume variable costs in a component can be expressed by the product of the component's accrued cost and its elasticity. *Id.* A close review of the mathematics underlying that formulation, however, shows that it implies exactly the opposite of the Public Representative's assertion. When a component's accrued costs are multiplied by its elasticity to calculate the volume variable costs, the only costs that are attributed to a product are the change in costs associated with the product's change in volume.

To see this, consider component *j*. The total volume variable costs for that component are given by:

$$VVC_j = C_j \varepsilon_j.$$

The elasticity is simply the marginal cost with respect to the cost driver times the ratio of the total component driver to accrued costs. Therefore, total volume variable cost can be rewritten as:

$$VVC_j = C_j \frac{\partial C_j}{\partial D_j} \frac{D_j}{C_j} = \frac{\partial C_j}{\partial D_j} D_j.$$

The total volume variable cost for Product A is the total volume variable cost for the component times Product A's share of the cost driver:

$$VVC_{Aj} = \frac{\partial C_j}{\partial D_j} D_j \frac{D_{Aj}}{D_j} = \frac{\partial C_j}{\partial D_j} D_{Aj}\ .$$

This equation shows that the causal path from the product to the component cost comes through the change in component cost caused by the change in the driver. The last step

is to link the Product A's volume to the amount of the driver it requires. That is done by calculating unit volume variable cost:

$$UVVC_{Aj} == \frac{\partial C_j}{\partial D_j}\frac{D_{Aj}}{V_A}.$$

In the established methodology this is equal to:[5]

$$UVVC_{Aj} == \frac{\partial C_j}{\partial D_j}\frac{\partial D_{Aj}}{\partial V_A}.$$

Contrary to the Public Representative's mistaken claim, this expression unambiguously shows that the established methodology strips out any common costs not caused by Product A. Thus, there is a fundamental difference between volume variable costs and inframarginal costs.

II.A.4: Mathematical Demonstrations That a Product's Inframarginal Costs Do Not Include Common Costs and that the Public Representative's Proposed Formula for Those Costs Is in Error.

Just as the calculation of a product's marginal cost does not involve an allocation of common costs, the correct calculation of inframarginal cost does not involve an allocation of common costs across products.[6] A product's incremental cost measures the total costs associated with all units of that product and thus requires valuing each unit at its own marginal cost. Total volume variable cost, which is used to calculate

[5] Because the derivative of the total amount of the driver respect to the amount of the driver required by Product A is equal to one, unit volume variable cost can also be written as:

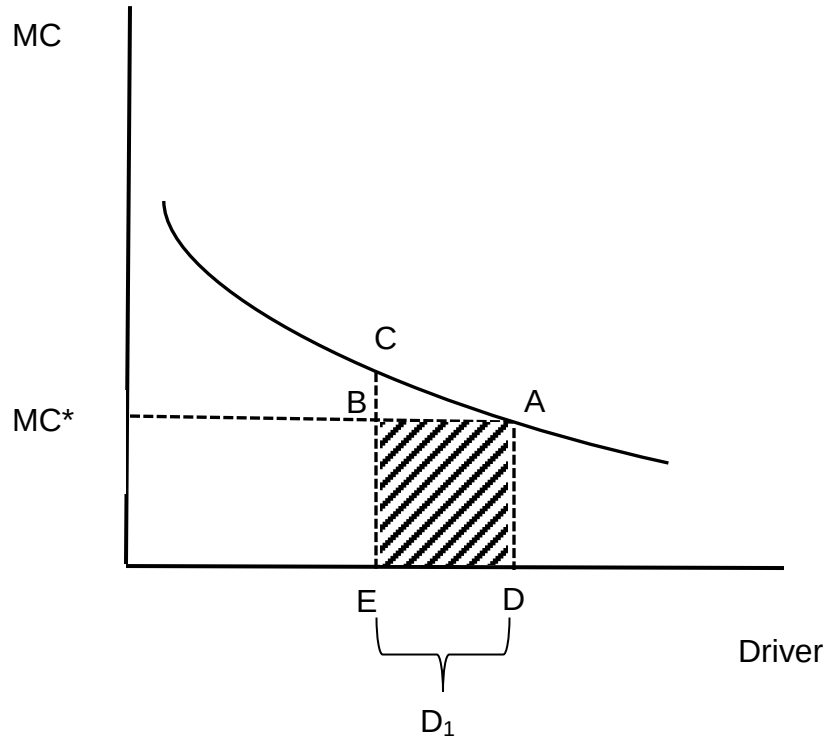
$$UVVC_{Aj} == \frac{\partial C_j}{\partial D_j}\frac{\partial D_j}{\partial D_{Aj}}\frac{\partial D_{Aj}}{\partial V_A}.$$

[6] This mistake also plagues Dr.Neels's analysis. *See* Bradley Report at 29.

marginal cost, values each unit at the marginal cost of the last unit. The difference between the two is the product's inframarginal cost.

Figure 2 below, which shows the marginal cost curve for a cost component, represents this graphically. Suppose that Product One requires an amount of the cost driver given by D_1. Then Product One's amount of the driver is given by the distance between Point D and Point E on the abscissa.

Figure 2
Marginal, Incremental, and Inframarginal Component Costs



Total volume variable cost for Product One is given by multiplying D_1 times MC* or the shaded rectangle defined by the four points DABE. Product One's incremental cost is the sum of each unit of the driver times its marginal cost or the area given by DACE. The difference between the two is Product One's inframarginal cost and is given by the area ABC. We can use this relationship to derive the correct expression for a

product's inframarginal cost. A product's inframarginal cost is the difference between its incremental cost and its total volume variable cost:[7]

$$\underset{Cost}{Inframarginal} = \underset{Cost}{Incremental} - \underset{Cost}{Total\,Volume\,Variable}.$$

To make the calculation of a product's actual inframarginal cost more concrete, recall the two-product example. With two products, the incremental cost of the first product is the total cost for both products minus the cost of providing just the second product:

$$IC_{1j} = \alpha_j\left(D_{1j} + D_{2j}\right)^{\beta_j} - \alpha_j\left(D_{2j}\right).^{\beta_j}$$

At the same time, the first product's total volume variable cost is simply the component volume variable cost multiplied by proportion of the cost driver required by the first product:

$$TVVC_{1j} = \beta_j\left[\alpha_j\left(D_{1j} + D_{2j}\right)^{\beta_j}\right]\frac{D_{1j}}{D_j}.$$

Plugging the formula for incremental and volume variable cost into the above equation yields the correct formula for first product's inframarginal cost:

$$IFMC_{1j} = \alpha_j\left(D_{1j} + D_{2j}\right)^{\beta_j} - \alpha_j\left(D_{2j}\right)^{\beta_j} - \beta_j\left[\alpha_j\left(D_{1j} + D_{2j}\right)^{\beta_j}\right]\frac{D_{1j}}{D_j}.$$

The actual formula for the product's inframarginal cost in component *j* can now be used to test the accuracy of the Public Representative's assumed formula. For clarity, we designate the Public Representative's asserted formula (Public Representative

[7] The simplified exposition here assumes that there are no product-specific fixed costs. If there were, they would have to be subtracted from the product's incremental cost before calculating its inframarginal cost.

Comments at 30, equation 9) with a cap:

$$\widehat{IFMC}_{1j} = \left(1-\beta_j\right)\left[\alpha_j\left(D_{1j}+D_{2j}\right)^{\beta_j}\right]\frac{D_{1j}}{D_j}.$$

To see if the Public Representative is correct, his asserted formula can be compared with the actual formula. The asserted formula will be correct if:

$$\widehat{IFMC}_{1j} \stackrel{?}{=} IFMC_{1j}.$$

Substitution of the two formulae into the test equation yields:

$$\left(1-\beta_j\right)\left[\alpha_j\left(D_{1j}+D_{2j}\right)^{\beta_j}\right]\frac{D_{1j}}{D_j} \stackrel{?}{=} \alpha_j\left(D_{1j}+D_{2j}\right)^{\beta_j} - \alpha_j\left(D_{2j}\right)^{\beta_j} - \beta_j\left[\alpha_j\left(D_{1j}+D_{2j}\right)^{\beta_j}\right]\frac{D_{1j}}{D_j}.$$

Cancellation of common terms shows that this condition will hold if and only if:

$$\left[\alpha_j\left(D_{1j}+D_{2j}\right)^{\beta_j}\right]\frac{D_{1j}}{D_j} \stackrel{?}{=} \alpha_j\left(D_{1j}+D_{2j}\right)^{\beta_j} - \alpha_j\left(D_{2j}\right)^{\beta_j}.$$

Or,

$$\left[1-\frac{D_{1j}}{D_j}\right]\alpha_j\left(D_{1j}+D_{2j}\right)^{\beta_j} \stackrel{?}{=} \alpha_j\left(D_{2j}\right)^{\beta_j}.$$

Or,

$$\frac{D_{2j}}{D_j} \stackrel{?}{=} \frac{\left(D_{2j}\right)^{\beta_j}}{\left(D_{1j}+D_{2j}\right)^{\beta_j}}$$

Note that this condition will only hold for the special case that $\beta_j = 1$. But that special case is of no value to the Public Representative's assertion, as in that case inframarginal cost goes to zero.